Surface Matters
Education Anthology
Newsletter of the Arizona Geographic Information Council

GIS Programs in Arizona

Welcome to this special publication of *Surface Matters*! This is a collection of all the stories we've done so far describing the GIS programs at Arizona's universities and community colleges.

We hope you find this to be a useful reference, but it is by no means a complete list. We will continue to seek out venues of GIS education in the state and bring them to you.

Please note that these articles are reprinted as originally published. No updates have been made.

GIS at the University of Arizona

Originally published September 2005

At the University of Arizona, GIS software is used in disciplines all over the campus. From geography and natural resources, to geoscience, to anthropology, agriculture, mining engineering, and even medicine, professors and students are performing geographic analysis. This is not to say that they're all becoming GIS experts; far from it. Rather, the principles of geographic analysis have made their way into subjects across the spectrum of education.

Academics

Classes that specifically teach GIS are offered through the Department of Geography and Regional Development and the School of Natural Resources. Some can be taken for credit in either department, and two of the classes are taught jointly between Geography and Natural Resources; that is, different instructors teach different topics in these classes during the semester. Eight classes in total are available, but that does not include related courses like remote sensing, image processing, or surveying. Other courses that rely on geography are found in various departments, depending on the discipline being pursued.

Students who enroll in GIS classes have two primary computer labs on campus in which to do assignments, one in Geography and the other in Natural Resources. In the Geography Department it is the Spatial Analysis Lab, which is mostly used for formal labs but sometimes serves as the classroom for one of the courses. It has thirty seats and is used for both GIS and remote sensing. In addition to this lab, Geography also operates the GeoVisualization Lab, which is used for research projects and upper-level GIS courses. The GeoViz Lab has its own web site which lists current projects being conducted there. In the School of Natural Resources the main location is the Instructional Computing Facility, where labs are held for a variety of classes. After their formal lab hours students can use a second lab called the Open Computing Facility.

For those who want GIS to be an integral part of their studies, the Geography Department offers an undergraduate GIS minor. This is the only such undergraduate minor at the university. Within the School of Natural Resources, graduate students majoring in natural resources can take a minor called Natural Resources Information Systems. On the PhD level, students can arrange to take a minor called Remote Sensing and Spatial Analysis. This is an inter-disciplinary program that requires students to take classes from a core group, plus additional classes from their majors.

Another option, still awaiting approval by the Arizona Board of Regents, will be the much- anticipated Geographic Information Science Certification Program, which will be available at the graduate level. This program was developed cooperatively between the School of Natural Resources and the Department of Geography and Regional Development. Although not yet available, many students have already expressed interest and the colleges are anxious to get it started.

Work Experience

Students can gain valuable experience in GIS and related disciplines by seeking out jobs that become available on campus and off. On-campus jobs can include working in a computer lab, being a research assistant, or working in one of the university's research facilities. Three such facilities that use GIS, remote sensing, and related technologies are the Center for Applied Spatial Analysis (CASA), the Advanced Resource Technology Group (ART), and the Arizona Remote Sensing Center (ARSC). These facilities typically hire graduate students.

continued on page 2

University of Arizona

continued from page 1

Off-campus jobs are usually with local government offices, though sometimes a Federal office like the U.S. Geological Survey or the Department of Agriculture will have a position available. In most cases a manager at a given agency will contact a professor with the job information. The professor then posts a job notice and it's up to the students to take it from there. The procedure is very decentralized, but many undergraduate and graduate students find valuable employment. Of course the university also operates the Career Services Center, through which students can look for on- or off-campus jobs, work-study programs, and internships.

Finally, students and teachers alike can sign up for the university's GIS listserve, a group e-mail account in which members can exchange information and ideas, ask for help with GIS problems, and post job notices.

Further Information

University of Arizona: http://www.arizona.edu
Admissions Office: http://admissions.arizona.edu
College Catalogs:
http://catalog.arizona.edu/allcats.html
School of Natural Resources:
http://www.ag.arizona.edu/srnr
Department of Geography and Regional Development:
http://geog.arizona.edu
GeoVisualization Lab: http://geoviz.geog.arizona.edu
Center for Applied Spatial Analysis:
http://www.casa.arizona.edu
Advanced Resource Technology Group:
http://www.ag.arizona.edu/art
Arizona Remote Sensing Center:
http://www.arid.arizona.edu/Divisions
Career Services: http://www.career.arizona.edu

GIS listserve: uagis@ag.arizona.edu ◊

Surface Matters is the quarterly newsletter of the Arizona Geographic Information Council. It is written for those who want to stay in touch with the vision and activities of AGIC and with the continuing growth of GIS in Arizona.

Your comments about this publication are always welcome. Please send all correspondence to the editor.

Readers are invited to submit articles that they wish to be considered for publication. The author retains all copyrights. Please let the editor know if the article has been published elsewhere.

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GIS at Northern Arizona University

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Those who prefer to study in the cool, forested climes of northern Arizona have a well-established GIS curriculum at their disposal at NAU.

Courses

The academic home of GIS on the NAU campus is the Department of Geography, Planning and Recreation (GPR). This is the department that offers classes and programs in GIS and operates the lab facilities. Other departments like Engineering, Biology, and Anthropology make use of GIS in some of their classes but don't teach it as a separate subject. A few new departments, like English and History, are becoming interested in the potential of the technology as well.

Nine GIS classes are offered in the GPR Department. After the introductory courses a student can go on to study such topics as project design, programming, database management systems, and environmental modeling. Separate courses are offered in raster and vector analysis. In addition, four remote sensing classes provide instruction in introductory principles, analysis techniques, instrumentation, and data gathering methods.

A few departments offer classes that make use of geographic analysis as part of their curriculum. For instance, the Geology Department has a field class in which students use notebook computers supplied with aerial photographs and GIS software. The Engineering Department teaches a surveying class that includes data gathering with GPS equipment.

Students within GPR have access to a central GIS teaching lab. The lab is equipped with 40 computer terminals, a large-format digitizing tablet, a large-format plotter, and printers for both color and grayscale output. Some professors teach their classes entirely in the lab, while others give lectures in separate classrooms and use the computer lab for software instruction. When it's not being used for scheduled classes, the lab is open for general use.

Academic Programs

Because GIS is so widely applicable on so many levels, NAU offers a complete range of related academic programs. Students can choose from four different options: an undergraduate minor, an undergraduate major, a graduate certificate, and a new interdisciplinary Master's degree, the Master of Science in Applied Geographic Information Science. All of these options are offered through the Department of Geography, Planning, and Recreation.

A minor in Geographic Information Systems requires 20 units and covers the basics of mapping and GIS. Meanwhile, three undergraduate majors are available as Bachelor's degrees:

a) The Extended Bachelor of Science in Geographic Information Science

b) The Extended Bachelor of Science in Applied Geography, Geographic Information Management Emphasis

c) The Extended Bachelor of Science in Public Planning, GIS & Planning Emphasis.

Next is the graduate-level GIS certificate, which is somewhat unusual in its focus. It is designed for working professionals who need to equip themselves with GIS skills. It isn't meant to be an extension of a Bachelor's program or a precursor to a Master's program. The philosophy behind it is that GIS skills are in great demand and that professionals in many disciplines may find themselves in need of such skills. As students progress through the program they gain knowledge and abilities that they can take right back to the office.

The certificate requires 18 hours of graduate-level courses and students who wish to enroll must have at least a Bachelor's degree. A student need not be in a graduate program to earn the certificate. If a current NAU student wants to enroll in the program, it is advised that he earn the certificate before enrolling in a Master's program. That way, if he wants to continue with school and earn the higher degree, he will have sound GIS skills to apply to his graduate work and can concentrate on his major subject.

Finally, NAU has the Master of Science in Applied Geographic Information Science, a new program which began in the fall of 2005. It is an interdisciplinary degree that can be taken with a thesis emphasis or a non-thesis emphasis. The thesis-emphasis program is meant for professionals who are already engaged in using GIS and/or remote sensing and is suitable preparation for pursuing a doctoral degree. The non-thesis emphasis is for students who are not using GIS or remote sensing professionally and who do not wish to pursue a PhD. A professional paper is required in lieu of a thesis.

Work Experience

Students who want to gain GIS experience while they're studying can either seek an assistanceship or an internship. Typically only graduate students become research assistants, but talented undergraduates have been known to land such positions as well. For undergraduates an internship is usually the way to go, because NAU has a very active internship program. Several agencies in the region regularly hire interns.

Students are expected to contact the organizations and set up their own programs. Some internships are paid, some are not, but all are for credit. Usually during the last week of an internship a faculty coordinator will visit the intern at the site to evaluate the experience and get feedback from the hiring organization.

Finally, in addition to everything else, a campus GIS e-mail list is available for students and teachers to exchange information.

continued on page 4

GIS at ASU (and ASU East and ASU West)

Originally published March 2006

Okay, this is going to take some explaining. Arizona State University is an expansive entity, both academically and geographically. Three of its campuses offer GIS courses. Each campus will be discussed separately.

Courses

ASU Tempe: Geospatial technology is applied in many disciplines here, including the physical sciences, engineering, planning, geography, social science, and business. Courses in GIS, however, are taught only by the Geography Department, which also offers classes in remote sensing and air photo interpretation. Asking specifically about "GIS classes," though, will garner different answers from different people, because several classes offer combinations of spatial analysis techniques, software, programming, or spatial concepts. It's better to ask about courses in the geospatial realm and pick the ones that meet your needs. It should be noted that the Department of Geology offers remote sensing classes as well.

Students working on assignments have a few different locations to do them. The Department of Geography has two computer labs for undergraduates and one for graduate students. Some GIS software is also available in the Computer Commons. For students outside of geography, the School of Planning and the School of Life Sciences both have labs for graduate students that feature geospatial software.

ASU Polytechnic: For most of its life this campus in Mesa has been known as ASU East. Recently the name ASU Polytechnic was adopted to reflect its focus on applied sciences.

At present the Polytechnic campus offers one GIS class and one remote sensing class for undergraduate students. They are given by the Department of Applied Biological Sciences, which is in the East College. Both are upper-division introductory courses. Three other classes actively use GIS as part of their lessons but the classes are not primarily focused on GIS as such. At the graduate level is a class in spatial modeling and a more advanced class in remote sensing.

One computer lab is available for the GIS students. It is used for teaching but is open for general use when not being used for instruction. The Computer Commons facilities also have GIS software. In addition, several professors apply GIS in their own research, so other computers on the campus have access to GIS software for research purposes.

ASU West: This campus in Glendale offers one upper-division undergraduate course in GIS, through the Department of Social and Behavioral Sciences. It is taught each semester, but only on Friday mornings in one 3.5-hour stretch. It is a four-credit lecture and lab class. The course number on this campus is GCU 373, while the same course on the Tempe campus is GPH 373. In Tempe the class is stretched across the week rather than compressed into a single day.

The class it taught in the computer lab where students also do their assignments. When class is not in session, the lab is available 24 hours per day. The campus computer center, called Technopolis, also has the appropriate software to complete the coursework.

Academic Programs

ASU Tempe: If you're looking for options, this is the place to be. An enumeration is in order.

Undergraduate – One can minor in GIS or get an undergraduate GIS certificate. The certificate requires 19 credits of specified courses and is available only to those who are otherwise pursuing a degree (in any field). Geography majors can pursue a Bachelor's degree with a GIS emphasis; requirements for the certificate still apply.

Graduate – This parallels the undergraduate program. A graduate GIS certificate is available to students who are enrolled in any degree program, provided they complete the required credits.

GIS Master's – This is a new program designed for working adults. Called the Master of Advanced Study in Geographic Information Systems, it is a 12-month, non-thesis degree with classes that meet at night and on weekends. Be forewarned, though: classes are three hours per night, five nights per week. It is a curriculum for hardy souls, not to be embarked upon lightly.

continued on page 5

Northern Arizona University

continued from page 3

Further Information

Northern Arizona University: www.nau.edu
Admissions, Graduate: www.nau.edu/gradcol
Admissions, Undergraduate: www4.nau.edu/uadmissions/admis/home.htm
Department of Geography, Planning & Recreation: www.geog.nau.edu
Career Center: www4.nau.edu/career

GIS Programs Coordinator
Leland Dexter, PhD, Professor of Geography

GIS Internship Coordinators
Leland Dexter, PhD, Professor of Geography
Dawn Hawley, PhD, Associate Professor

Agencies that frequently hire interns
Grand Canyon Trust
City of Flagstaff
City of Sedona
Coconino County
Arizona Game & Fish Department
National Park Service
U.S. Forest Service
U.S. Geological Survey ◇

Arizona State University

continued from page 4

ASU Polytechnic, ASU West: Degrees are not duplicated on the different campuses, so these locations don't offer programs centered on GIS. The courses they offer can be used toward a degree being pursued on the Tempe campus.

Work Experience

For students who would like to gain practical experience with geospatial technology, internships, on-campus jobs and off-campus jobs are available.

ASU Tempe: The Geography Department has its own internship program, through which a student can earn up to six credits. Students must work three hours per week per credit, so a typical 3-credit internship would require nine hours of work per week. Those signed up for the credits must also take a related class, which meets for three weeks at the beginning of the semester and one week at the end. Interns are typically employed off campus at a government office or sometimes at a private business.

Student jobs, whether taken as internships or not, are available for both graduate and undergraduate students. On-campus jobs come through three venues: at the GIServices lab, through individual faculty who are conducting research, or at one of several on-campus research institutes.

When jobs or internships become available they are announced through the Undergraduate Geography Majors listserve, through the GIS listserve, and on the Geography Department jobs web site.

ASU Polytechnic: No formal internship program exists here as it does on the Tempe campus, but the different college departments have faculty or staff who act as internship coordinators. Internships become available on an as-needed basis. Similarly, on-campus jobs as research assistants or hourly employees arise when the need occurs. Such opportunities are posted on departmental bulletin boards and sent through the GIS listserve.

ASU West: As with the Polytechnic campus, ASU West has internship coordinators in the various colleges but there is no formal program. Because this campus has only one GIS instructor, on-campus jobs are rare, though students are sometimes hired as research assistants when the need arises.

Students seeking a robust GIS education will have to attend the Tempe campus. Geospatial technology, however, is constantly being applied to new fields and applications. ASU recognizes this and is incorporating geospatial education into its programs of study across all of its campus locations.

Further information

ASU Home: www.asu.edu
Admissions: www.asu.edu/apply
Geography Department: geography.asu.edu
Geography Jobs Board: geography.asu.edu/jobs
Career Services: www.asu.edu/studentaffairs/career

Polytechnic Campus: www.poly.asu.edu
Dept. of Applied Biological Sciences:
www.poly.asu.edu/ecollege/appliedbiologicalsciences
Career Services: www.poly.asu.edu/students/career

West Campus: www.west.asu.edu
Dept. of Social & Behavioral Sciences:
www.west.asu.edu/sbs
Career Services: www.west.asu.edu/sa/cspc

Geography Internship Coordinator
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Department of Geography

Types of organizations that hire GIS interns
Federal and state agencies
City planning and GIS departments
Aerial photo companies
Real estate companies
ASU Department of Geography – on specific projects
Various ASU research institutes ◇

GIS at Mesa Community College

Originally published June 2006

Attending a university isn't a prerequisite for getting a solid foundation in spatial technology. Mesa Community College (MCC) has a vibrant GIS program that offers students a sound academic basis, practical applications, and work experience.

The Program

MCC offers a program that leads to a Geographic Information Systems Technician Certificate. The curriculum stresses geographic concepts and principles while applying practical exercises using geospatial software. The guiding philosophy is that a student so equipped will be able to apply his GIS knowledge to any given field and be able to adapt to whatever GIS software he encounters.

Students in the program can follow one of three different tracks. The User/Analyst track is for those interested in producing, editing, and analyzing spatial data. The Programmer/Developer track includes many of the methods found in the User/Analyst track, but its emphasis is on developing GIS software applications through programming. The final option is the Bachelor of Science: GIS Emphasis track, which is for those students who want to transfer to a university to pursue a Bachelor's degree with a GIS emphasis. The certificate requires four core GIS classes, plus four additional classes that depend on the student's academic path, plus an internship.

The Courses

The GIS courses at MCC consist of beginning, intermediate, and advanced GIS using ArcGIS software, and a class in cartography and geospatial technology. Each is taught one night per week, from 5:45 to 8:30 PM. Significant lab time is available during class sessions, but the lab/classroom is also available for limited periods outside of class. Typically it is open for 10 hours per week during the weekdays, plus four hours on Saturday. The lab has 20 computer stations.

The classes are taught at night because of the demographics of the student population. Most of the demand comes from working adults who are seeking to increase their skills for their careers. Attempts have been made to teach the classes during the daytime, but most of the students who are just coming up through high school aren't aware of GIS and don't enroll in the program.

The certificate program is administered by the Geography Department, which offers the core GIS courses and the internship credits. The additional courses for the three different certificate tracks are given by the Computer Information Systems and Mathematics Departments.

Pursuing an internship at MCC is much like pursuing one at a university. A student must sign up for the internship class and will receive from one to three credits depending on how many hours are worked. The formula is one credit hour per twenty hours of work to be completed within the semester. The internship entails identifying a GIS-related project that meets instructor approval. The person who will be supervising the project completes a contract that includes a description of the tasks and goals the intern will be expected to perform during the internship. Weekly timesheets signed by the student and supervisor are submitted to the instructor once the internship has begun.

Finding an internship can be a bit haphazard. Sometimes a company or government agency will contact the college to offer an internship and the position will be announced in class. On other occasions a student must contact potential employers to find out if an internship is available. Some internships are paid, others are not.

The Future!

Mesa Community College is not content to maintain a geospatial status-quo. Many plans for future growth are in the works.

- A geography listserve will soon be operational, which will allow interested students and teachers to exchange information and post job notices.
- The following new classes are in development:
  - Fall 2006 – Introduction to Spatial Database I
  - Spring 2007 – Introduction to Internet Map Server
  - Spring 2007 – Introduction to Remote Sensing (ERDAS)
  - Fall 2007 – an online course in introductory GIS
- An Engineering track will be added to the options for the GIS certificate.
- Partnerships between the Geography Department and other departments on campus will be forged, allowing for the introduction of geographic principles and spatial technology into other academic disciplines.
- Partnerships between the college and local businesses and organizations will be pursued, allowing MCC to more directly serve the interests of the community.
- A new Associate's degree, Applied Science in GIS, will be developed.

Further Information

MCC home: www.mc.maricopa.edu
Admissions:
www.mc.maricopa.edu/students/admissions
Career services:
www.mc.maricopa.edu/students/career

Geography Department:
www.mc.maricopa.edu/dept/d10/gph
GIS Certificate details:
www.mc.maricopa.edu/dept/d10/gph/gistc/index.html

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Phoenix College to Begin GIS Program

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Starting in the fall semester of 2006, the Phoenix College Biology Department will offer a new, 4-semester GIS program that can lead to GIS Technician certification. The program is called Geospatial Technology for Environmental Sciences. It will consist of four 4-credit classes, at the end of which students can take a certification test.

All of the classes will stress a project management approach, guiding students through the steps of collecting, editing, analyzing, and presenting data. Along the way a wide range of concepts and applications will be introduced and implemented. The first course will introduce beginning concepts and skills and will make use of GIS software, GPS hand units, aerial and satellite imagery, and even a satellite orbit simulation program. The second through fourth courses will use ArcGIS, some of its extensions, and other software for the exercises and projects.

Each class is based on working through projects, not simply doing generic exercises. Exercises will be completed as part of the learning process, but the skills learned will then be implemented in structured applications. The final semester will be a self-directed class in which the students devise, implement, and complete projects on their own.

A unique aspect of the program is that the data are customized to the campus and its surrounding community. The data used for projects will either be collected on the grounds of Phoenix College, or will be Maricopa County layers that are supplied in class.

The program will use a comprehensive curriculum called SPACESTARS, an acronym for Spatial Projects And Community Exchange/Spatial Technology And Remote Sensing. This curriculum was developed jointly by Digital Quest, Inc. and the Berkeley Geo-Research Group. The test that students can take at the end of the four semesters will be for the STARS GIS Technician Certification. The certificate will be awarded by the SPACESTARS organization, not by Phoenix College. The certification is endorsed and sponsored by the Mississippi Enterprise for Technology, a partnership of 29 public and private institutions including the NASA Stennis Space Center, the U.S. Army Corps of Engineers, and the Mississippi universities.

For descriptions of the courses and class schedules:
www.phoenixcollege.edu/biology

To learn about the curriculum developers and sponsors:
www.spacestars.org
http://mset.org ◇